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AUTHOR	MacLeod, Lonny G.; Morrison, Gary R.
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ABSTRACT

This paper describes a study designed to investigate the effectiveness of narrative versus step-by-step instructions for a computer task. The participants in this study were 31 undergraduate education students enrolled in a computer literacy class at the University of Memphis during the Summer 1996 semester; none of the participants had prior knowledge of e-mail. Participants were randomly assigned to one of the two treatment groups and were individually observed as they completed the steps for retrieving, replying, spell checking, and sending e-mail using software on a mainframe computer. After completion of their respective treatments, participants completed a survey designed to assess their attitudes toward the instruction. There was no performance time difference between the two groups, but the step-by-step treatment made fewer errors during the more complex tasks. There was a lack of difference in attitude between the two groups. A figure illustrating the performance rating form used by the researchers is included, as well as tables containing data on errors on task and errors by treatment. (DLS)

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By:

Lonny G. MacLeod
Gary R. Morrison

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Narrative Versus Step-by-Step Instructions for Computer Procedures

Lonny G. MacLeod
Gary R. Morrison
University of Memphis

Abstract

The purpose of this study was to investigate the effectiveness of narrative versus step-by-step instructions for a computer task. Naive participants were observed as they completed the steps for retrieving, replying, spell checking, and sending email using software on a mainframe computer. There was no performance time difference between the two groups, but the step-by-step treatment made fewer errors during the more complex tasks.

One problem often slighted in the software development process is the development of appropriate documentation for the user. This observation is supported by the growing number of after-market software books and the growing need for software technical support. Although there are many examples of excellent software manuals, there are also numerous examples of manuals that offer little more than a programmer's description of how the software works. An analysis by Kaplan (1989) revealed five types of software documentation: reference manual, tutorial manual, user (or combination) manual, quick reference card, and on-line help. She believed that for novices, ". . . the tutorial is the most essential piece of documentation" (p.32). One problem with tutorials is the writer's potential for underestimating the intelligence of the user and sinking to the "Dick and Jane" level (Deterline, 1988).

McGehee (1984) defined tutorials as "a cookbook, hand-holding, step-by-step method of teaching the concepts and techniques of using a program" (p.57). It is interesting to note that McGehee's definition uses the term step-by-step, which suggests a non-narrative approach. Tutorials are recommended by McGehee if the manual is the user's first introduction to a program, if the program is complex, and if the user is a computer novice. The major problem identified with writing tutorials is trying to match the user's knowledge, a problem that depends on the particular software and the intended audience. Deterline (1988) issued a plea for inclusion of user needs when documentation is written, because much software documentation is written by subject-matter experts (SME), often the computer programmers and it is very difficult for non-experts to comprehend.

If the documentation manuals are the user's first contact with the software, how should the information be presented? Brockmann (1990) discussed the limitations of tutorials in general, which he believes may constrain users to a set of minimum expectations. Tutorial material is "usually organised around user tasks or around a hierarchy of user needs" (p. 74) In contrast, Thurston (1986) states that general purpose computer programs (e.g. programming languages) are better served with narrative form tutorials, while narrowly defined programs (e.g. accounting packages) are best dealt with using step-by-step tutorials. Webb (1989) also recommended step-by-step tutorials for procedures and narrative form for overviews or introductions. "Cookbook" tutorials which consist of simple action sentences (e.g. Turn on computer. Click on icon for program. Select word processing) differ in form from numbered steps which move users sequentially through a procedure tutorial (e.g., 1. Turn on computer. 2. Locate the program's icon. 3. Double click on the icon. 4. When the program starts, find the box for word processing and click on it). Tutorials, regardless of form should begin with a general overview and include as many illustrations as possible. However, Kaplan (1989) suggests that narrative style instruction often hides important messages in a mass of text. Although the use of numbered steps makes logical sense for complex tasks, a review of the instructional design literature failed to identify any research comparing narrative versus step-by-step approaches to teaching procedures.

The purpose of this study was to investigate the effectiveness a narrative versus step-by-step presentation of a procedure for naive computer users. It was predicted that the step-by-step approach would be more time efficient, since a narrowly focused application (email) was used in the study. It was also predicted that participants receiving the step treatment would make fewer overall errors and fewer errors of each type. We were also interested in knowing how the two treatments influenced participants' attitudes toward the instructional materials.

Method

Participants

The participants in this study were 31 undergraduate education students enrolled in a computer literacy course at the University of Memphis during the Summer, 1996 semester. The participants generally had little computer experience and many suffered from "computerphobia." None of the participants had any prior knowledge of email. Participants were randomly assigned to one of the two treatment groups.

Materials

The treatment material consisted of a three part instructional unit providing information on how to log onto the University EMAIL system, read and compose email, spell check, reply to, and send messages. The instructions encouraged students to proceed at their own pace.

Lesson Description

A unit of instruction was on how to use the University's VAX EMAIL server, compose, read, spell check, reply to, and send EMAIL messages using the VAX software. The first treatment group was the narrative treatment (n=15). This treatment group read text presented in a traditional narrative format with each paragraph including from three to seven steps. The following is a sample of the narrative treatment.

> Turn on your computer. After the computer has finished its start-up process, you will see the "Finder" screen. Use the mouse to move the arrow to the Apple icon (picture) in the top left corner of the screen. With the arrow pointing at the Apple icon, press the mouse button and hold it down.

The second treatment group (n=16), step-by-step, read instructions that were clearly enumerated and separated from each step. The following is a sample of the step-by-step treatment.

1. Turn on your computer.
2. After the computer has finished its start-up process, you will see the "Finder" screen.
3. Use the mouse to move the arrow to the Apple icon (picture) in the top left corner of the screen.
4. With the arrow pointing at the Apple icon, press the mouse button and hold it down.

The two treatments contained the same information but varied in the way it was displayed on the page. The only difference was the numbering of the steps in the second treatment.

Instruments

After completion of their respective treatments, participants were given a survey designed to assess their attitudes toward the instruction. The attitude survey consisted of six core items that asked participants to rate the lesson, computer learning, the VAX system, the usefulness of email, this lesson, the sufficiency of items, and future email use using a five point Likert scale (1=strongly disagree, 5=strongly agree). The second instrument was an observation form used by the experimenter during the treatment. The form listed each step of the process with places to indicate if the step was performed correctly and in sequence, performed incorrectly, performed correctly out of sequence or skipped. There was also a place for noting the starting and ending times and a section for noting participant behaviors (see Figure 1).

Figure 1. Performance Rating Form

Step / Outcome	Correct	Wrong Command Key	Wrong Entry Typed	Wrong sequence but worked	Wrong Sequence error	Other
Starts up computer.						
Logs on successfully.						
Changes password if necessary.						
Reaches mail prompt.						
Creates new message.						
Enters message.						
Sends message.						
Logs on successfully.						
Reaches mail prompt.						
Reads new message.						
Replies to message.						
Spell checks message.						
Sends message.						

Procedure

Participants were scheduled to complete the instruction in a one-on-one setting with the experimenter. Each was seated at a color Macintosh computer (LCII or LCIII) and given the printed instructions. The starting and ending times were noted for each participant. The experimenter observed each subject complete the tasks. The sequence of steps completed and the type of errors made were recorded by the experimenter using the following instrument. Each time a participant attempted a step, the participant's action was evaluated and recorded on the checklist.

Results and Discussion

The first analysis was a comparison of completion times and overall errors for each of the treatments with T-tests and using SPSS statistical software. No significant differences were found for time on task (times ranged from 19 to 23 minutes), or overall errors by treatment (overall errors ranged from 0 to 4).

The errors in the 13 steps in the procedure were summed into four groups: Steps 1-4 (initial logon); Steps 5-7 (composing and sending message); Steps 8-10 (logon and reading message); and Steps 11-13 (replying, spell checking and sending message). Only the final group of steps varied significantly by treatment when compared using MANOVA, with the step procedure group making fewer errors (F=5.0024).

Table 1. Errors on Task

Variable	Treatment #1 (Narrative)		Treatment #2 (Step)		F. Prob.
	Mean	*S. D.*	*Mean*	*S.D.*	*p<.05*
Error Steps 1-4	.200	.414	.563	.814	.1329
Error Steps 5-7	.600	.632	.313	.479	.1626
Error Steps 8-10	.067	.258	.000	.000	.3097
Error Steps 11-13	.533	.640	.125	.342	.0332

When type of errors by treatment were compared with MANOVA, only the Wrong Command Key errors differed, with the step procedure treatment group making significantly fewer errors (F=7.1382).

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Table 2. Errors by Treatment

Variable	Treatment #1 (Narrative)		Treatment #2 (Step)		F. Prob.
	Mean	*S.D.*	*Mean*	*S.D.*	*p<.05*
Wrong Command Key	.733	.704	.188	.403	.0122
Wrong Entry Typed	.400	.632	.750	1.065	.2790
Wrong Sequence but Worked	.133	.352	.063	.250	.5212
Wrong Sequence Error	.200	.414	.000	.000	.0629

MANOVA comparisons found no other significant differences between groups for Looks at Instructions, Asks for Help, or Shows Frustration. The attitude survey questions also revealed no significant differences between treatments, although both treatment groups recorded positive overall attitudes toward the instruction.

The lack of significant differences in times for the treatment groups may have resulted from a motivated participant group. All participants were required to learn to use email in their ongoing literacy course which may have resulted in a greater degree of learner engagement than might have otherwise occurred. Thus there was no support for the first hypothesis (the step approach will be more time efficient). This finding is in agreement with a study by Morrison, Ross, Case and Gopalakrishnan (1995) which found that purposeful engagement raised scores.

Similarly, there were no significant differences in overall errors by treatment in this study. This lack of difference may be due to the relative simplicity of the procedure, with few opportunities for errors. However, there were significant differences in performance on the most difficult part of the procedure (replying to a message, spell checking and sending the reply). The step-by-step group made fewer keystroke errors. This finding suggests that step-by-step procedures may produce fewer errors when the procedure is more complex. Participants using the narrative approach found this group of steps very difficult and often showed frustration while attempting to complete the tasks. The step-by-step group appeared to have gained enough confidence in their ability that they were not as intimidated by this portion of the lesson.

Significant differences were also found for Wrong Command Sequence errors. A Wrong Command Sequence error occurs when a participant presses the wrong key and is not successful at completion of the step. This result appeared to be due to a loss of concentration by participants receiving the narrative treatment. These participants often lost their place in the procedure because they lacked the number cues provided to the step-by-step participants. This finding is consistent with Thurston's (1986) recommendation that step-by-step procedures are more appropriate for narrowly defined applications such as email.

The lack of differences in attitudes by treatment may be explained by the participants' need to acquire the skill taught by the lesson. Some negative behaviors were observed during the treatments (mostly impatience over having to read the instructions), but the majority of the participants were positive (and often enthusiastic) about their new skill. Another factor that may have influenced performance and attitudes was the individualized testing situation. This approach was in direct contrast to the 20:1 student-instructor ratio in the computer literacy class. This one-on-one environment may have increased their confidence. Also, the treatment instructions were considerably more detailed than those provided in the textbook.

Most of the students (n=28) were forced to seek help from the experimenter at least once because of confusion over the procedure, especially when asked to choose a new password (problems included new password already in use and illegal password selected). Almost half (n=13) showed signs of frustration, especially when trying to press the CONTROL-Z key combination, which is a unique keystroke on a Macintosh. No participants attempted to explore the menus or other options and only one participant tried to send any additional messages.

It appeared from the observations that the major determining factor of success was the participant's motivation, not the format of the written procedure. Participants who experienced difficulty appeared to skip portions of the printed lesson and skimmed longer explanations which resulted in less understanding and more errors. Participants with higher motivation completed the tasks with few mistakes and displayed interest in the underlying structure of email. Those with lower motivation often ignored instructions (especially concerning spell checking) and showed little overall interest.

The differences in Control Key sequence errors indicated that the step procedure produced fewer errors. One possible explanation is that the more complex the task and the more critical the order of the steps, the more advantageous are the step procedures.

Overall, the results were less conclusive than predicted, but significant differences in two of the variables examined (Steps 11-13 and Wrong Command Sequence) indicates that there are measurable differences between the two methods of instruction.

Recommendations

The study indicated that differences in effectiveness of step-by-step procedures may be less than generally believed. The results of the study suggests additional research with complex procedures should be used to determine if complexity of task plays a part in differentiating methods of instruction. Future studies should include a variety of tasks that are simple and complex, short and long, and familiar and unfamiliar to the participant.

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